

## Claims

- [1] An apparatus for testing and analyzing a base station having a smart antenna, which is for a WCDMA (Wideband Code Division Multiple Access) mobile communication system, the apparatus comprising:  
a test analyzer body for performing management of a test call including channel establishment/release of the base station, connecting to the base station to generate mass mobile communication multimedia test calls, and measuring and analyzing an operational state of the system including service-specific functions and performance of the system; and  
a test analyzer interface for transmitting/receiving a protocol signal message, traffic, and performance data to/from the test analyzer body.
- [2] The apparatus as claimed in claim 1, wherein the test analyzer body comprises:  
a user interface for generating a test call so as to enable a direct connection to the base station for monitoring the performance of the system;  
a test call processor for selecting a protocol corresponding to the test call, analyzing a signal message for the protocol to monitor a call setup procedure, processing the test call to analyze traffic, and monitoring the quality of the traffic according to the analysis result of the traffic;  
a protocol processor for generating a signal message used for the selected protocol;  
a data processor for analyzing and processing the performance data of the test call processor; and  
a network interface for communicating with the test analyzer interface to transmit/receive the protocol signal message, the traffic, and a performance message.
- [3] The apparatus as claimed in claim 2, wherein the test call processor comprises:  
a test call analyzer for selecting a corresponding protocol according to the test call;  
a traffic analyzer for reporting the protocol signal message to the test call analyzer to monitor the call setup procedure, or reporting the analysis result of the traffic to the test call analyzer to monitor the quality of the traffic; and  
a signal message database for storing the signal message in order.
- [4] The apparatus as claimed in claim 2, wherein the data processor comprises:  
a data analyzer for analyzing the performance data of the test call processor; and

- a performance database for storing an analysis result of the data analyzer.
- [5] The apparatus as claimed in any one of claims 1 to 4, wherein the test call includes a voice, video, or Internet multimedia call, the test call communicating with a mobile station according to a corresponding protocol.
- [6] The apparatus as claimed in claim 2, wherein the protocol processor establishes a channel to a mobile station using a message stored in a signal message database according to the corresponding protocol.
- [7] The apparatus as claimed in claim 6, wherein when a channel to the mobile station is established, the protocol processor reports the result to the network interface and a traffic analyzer of the test call processor and transmits/receives the corresponding traffic to/from the mobile station.
- [8] The apparatus as claimed in claim 3, wherein the analysis result of the traffic includes an analysis result of a frame error rate, or a propagation delay.
- [9] The apparatus as claimed in claim 4, wherein the analysis result of the data processor includes an analysis result of a modulation/demodulation state, or an operational performance of the base station.
- [10] The apparatus as claimed in claim 4, wherein the data stored in the performance database are reported to the user interface by a request of an operator, enabling the operator to monitor the performance of the mobile communication system.
- [11] A method for testing and analyzing a base station having a smart antenna, which is for a WCDMA mobile communication system, the method comprising:
- (a) generating a test call so as to enable an operator to directly connect to the base station and monitor performance of the system;
  - (b) selecting a protocol corresponding to a test call input by the operator;
  - (c) generating a signal message used for the selected protocol;
  - (d) monitoring a call setup procedure according to the protocol signal message, or processing the test call to analyze traffic; and
  - (e) testing a function, performance, and an operational state of the base station according to the analysis result of the traffic, and analyzing performance data according to the test result.
- [12] The method as claimed in claim 11, further comprising:  
transmitting the protocol signal message, the traffic, and the performance data.
- [13] The method as claimed in claim 11, further comprising:  
storing the signal message and the performance data in a database.
- [14] The method as claimed in claim 11, wherein the test call includes a voice, video,

- or Internet multimedia call, the test call communicating with a mobile station according to a corresponding protocol.
- [15] The method as claimed in claim 11, wherein an operational state parameter tested in the step (e) is selected from a group consisting of a traffic frame quality, a bit energy-to-noise ratio, an operational performance of the base station system, and a mobile station location.
- [16] A communication protocol structure of an apparatus for test analysis of a base station, which is a communication protocol structure of an apparatus for test analysis of a base station having a smart antenna in a WCDMA mobile communication system, the communication protocol structure comprising:
- (a) an application layer for requesting a call control service to control a test call generated from a test analyzer body;
  - (b) a call control (CC) layer for performing the call control service and then requesting a mobility management service;
  - (c) a mobility management (MM) layer for performing the mobility management service and then requesting a radio resource control service;
  - (d) a radio resource control (RRC) layer for performing the radio resource control service and then requesting a radio link control service;
  - (e) a radio link control (RLC) layer for performing the radio link control service and then requesting a medium access control service;
  - (f) a medium access control (MAC) layer for performing the medium access control service and then requesting a frame protocol service;
  - (g) a frame protocol (FP) layer for performing the frame protocol service and then requesting an Ethernet service; and
  - (h) an Ethernet layer for transferring a service request of the test analyzer body to a test analyzer interface.
- [17] The communication protocol structure as claimed in claim 16, further comprising:
- a codec layer for processing multimedia traffic.
- [18] The communication protocol structure as claimed in claim 16, further comprising:
- a node-B application protocol (NBAP) layer for transmission of performance data between the test analyzer and the base station.
- [19] A communication protocol structure of an apparatus for test analysis of a base station, which is a communication protocol structure of an apparatus for test

analysis of a base station having a smart antenna in a WCDMA mobile communication system, the communication protocol structure comprising:

- (a) an application layer for requesting a call control service to control a test call generated from a test analyzer body;
- (b) a call control (CC) layer for performing the call control service and then requesting a mobility management service;
- (c) a mobility management (MM) layer for performing the mobility management service and then requesting a radio resource control service;
- (d) a radio resource control (RRC) layer for performing the radio resource control service and then requesting a radio link control service;
- (e) a radio link control (RLC) layer for performing the radio link control service and then requesting a medium access control service;
- (f) a medium access control (MAC) layer for performing the medium access control service and then requesting a frame protocol service;
- (g) a frame protocol (FP) layer for performing the frame protocol service and then requesting an Ethernet service; and
- (h) an Ethernet layer for transferring a service request of the test analyzer body to a test analyzer interface,

wherein the test analyzer interface processes services of the Ethernet layer and the frame protocol layer and transfers service requests of the application layer and the medium access control layer.

[20] A method for using a communication protocol among a mobile station, a base station, and a test analyzer, which is in a WCDMA mobile communication system, the method comprising:

- (a) transferring service requests from a plurality of protocol layers of a test analyzer body;
- (b) processing services of an Ethernet layer and a frame protocol layer among the plural protocol layers, and transferring service requests of an application layer or a medium access control layer;
- (c) carrying the service requests of the application layer or the medium access control layer transferred to the base station on an L1 (Layer 1) layer and transferring the carried service requests to the normal mobile station; and
- (d) processing the service from the normal mobile station in a reverse direction of processing the service requests among the layers of the test analyzer body.

[21] The method as claimed in claim 20, wherein traffic communication between the

test analyzer body and the normal mobile station is achieved through a codec layer for processing multimedia traffic.

- [22] The method as claimed in claim 20, wherein performance data transferred between the test analyzer body and the base station are transmitted to the test analyzer body via an NBAP layer.